SUMMARY OF DISCUSSIONS

before

Meeting of Representatives of

Wool Processing Industry

and

U. S. Department of Agriculture

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CURRENT WOOL SITUATION

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If one were looking at the wool situation in world terms, or from outside the United States, the conclusion might well be that the current situation is about normal.

This is, world production of apparel wool for 1953, currently estimated at 3,360 million pounds (grease basis), is about 12 percent above the prewar average, 2,991 million pounds, 1934-39. Current world consumption is running close to current production as compared with the prewar average of 3,103 million pounds. True, consumption and production are both running in terms of total pounds some 6 to 12 percent above the prewar level, but world population has also increased. Meanwhile, carry-in stocks of wool at the beginning of the 1953 season were about 2 billion pounds (grease basis) as compared with 1,825 million pounds during the prewar years 1934-39. This means that the wartime increase which raised stocks to 5,357 million pounds at the start of the 1945 season have been worked off. Pricewise, world wool prices generally no longer show much, if any, influence of the various factors affecting them during the World War II period or of the sharp inflationary rise which occurred following the Korean outbreak in June 1950.

But looking at the wool situation from the standpoint of the United States producers and domestic wool processor, there are several special features which need to be noted:

First, sheep numbers and wool production have not recovered from the very sharp decline which came in the early years of World War II. The number of stock sheep and lambs on farms and ranches in the United States declined from an estimated 49,346 thousand head on hand January 1, 1942, to 26,940 thousand head on January 1, 1949. There was a slight recovery from this 1949 level to an estimated 28,050 thousand head on hand January 1, 1952. But the numbers on hand January 1, 1953, were down fractionally and some further decrease is expected in the estimates for January 1, 1954. This decline of over 40 percent in the number of stock sheep and lambs on farms and ranches has been accompanied by a corresponding decline in wool production.

Second, processors have tended to shift increasingly to the consumption of foreign as compared with domestic wools both as a result of the decline in wool production in the United States and more recently the way in which the support price program for domestic wool has operated. Under the support price program there has been a tendency for wool to move into Commodity Credit Corporation stocks rather than domestic consumption since it appears that foreign wool prices have tended to shade slightly under the domestic support level. At the same time there has been a growing shift to synthetic fibers in a number of fields which has begun to cut into the wool market.

Third, tied in of course with the above two factors is the fact that domestic wool prices are again at a relatively low level, whether the comparison is made between prices for wool and other farm commodities or between prices of wool and costs to farmers and ranchers engaged in producing lambs and wool.

It seems to me that these special circumstances in our domestic wool situation lead into or define three separate sets of problems. The first of these has to do with the possibility of increased production efficiency on the part of farmers and ranchers. So far as our farm management people can determine, there have been no substantial increases in the productive efficiency of raising sheep or wool production over the last 15 years despite the fact we have had some very significant increases in yields per acre and productivity for many other farm commodities. This problem of productive efficiency and the possibility of cutting costs on the production side is of course chiefly one for the producers and research and educational agencies that work with them.

The second set of problems has to do with prices, including operation of the support price program as well as possible actions to give added tariff protection to domestic wool under Section 22 of the Agricultural Adjustment Act of 1938. Again, these are actions which fall outside the field of this particular group, involving not only this Department but also the Tariff Commission and of course the Congress itself. However, wool processors are interested in prices at which domestic wool moves. Price differentials do in considerable part determine whether domestic or foreign wool is used for particular purposes or at particular times, as well as having some effect upon the extent to which synthetic substitutes may further cut into the wool market.

A third major problem is the market problem. If we assume that most producers and processing groups would like to share in the increasing American standard of living, it follows that total consumption of such commodities as wool should gradually increase certainly at the same and probably at a somewhat greater rate than our population increases. Without going into a detailed discussion, I am attaching two tables which may be of interest. Table 1 shows average per capita mill consumption of cotton, wool, flax, silk, and various man-made fibers, by years of 1921 into 1952. Table 2 is in effect an analysis of Table 1 as it restates the per capita consumption of each fiber for each year as a percentage of the total fiber consumption falling within the competing group.

Very briefly, despite the fact that average per capita consumption of apparel wool in 1952 was 2.18 pounds as compared with an average per capita consumption of 2.15 pounds during the 5 prewar years, 1935-39, this second table indicates that wool has not been holding its own proportionately with other fibers. Cotton, which accounted for 80.6 percent of the consumption of fibers in 1935-39 had dropped to 70.2 percent average for the two years 1951-1952; apparel wool had dropped from 7 percent prewar to 5.5 percent average for the two years, and carpet wool from 2.4 percent prewar to 1.7 percent. But rayon and acetate fibers increased from 8.2 percent prewar to 18.8 percent, average 1951-1952, while other man-made fibers which were not in production on any commercial scale in 1935-39

accounted for 3.5 percent of the total over the last two years. This increasing competition from synthetics does raise a number of problems in which it seems to me that the wool producers and wool processors have a common interest.

In concluding, some remarks about the work of the Bureau of Agricultural Economics may be in order. Our Crop and Livestock Estimating Service of course maintains current estimates of sheep numbers and wool production, and we also obtain estimates of prices received by producers for lambs and wool. In addition, we maintain a continuous economic analysis of the wool industry, summarized from time to time in our publication, "The Wool Situation." We are also in a position to carry on certain special studies which this or similar groups might suggest as aids to increasing the efficiency of wool mill or processing operations or to maintaining or increasing the market for woolen products. We have made a number of consumer industrial surveys for various commodities some of which have certainly been well received by the trade, including a study of "Men's Preferences Among Selected Clothing Items," released as Miscellaneous Publication No. 706, December 1949, and a study of "Men's Preferances Among Wool Suits, Coats, and Jackets," released as Agriculture Information Bulletin No. 64, September 1951. Another study in which I believe some of you will be much interested is the wool grease study now being done with the Lowell Textile Institute. Such studies as these to be most useful have to be planned with the assistance of the industry representatives themselves and should of course have industry backing in order to see that the results are put to use as soon as possible. We would be very glad to consider any suggestions which this group might have to make as to ways in which the Bureau might be of assistance or aid.

Table 1.- Per capita mill consumption of cotton, wool, rayon and acetate, other man-made fiber, flax, and silk, United States, 1921-52

Year	Cotton 1/	Wool 2/			Rayon and acetate 3/	Other man-made 3/	Flax 4/	Silk 5/	Total
		Apparel	Carpet	Total					
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pound
1921	23.62	2.72	0.40	3.12	0.18		0.08	0.47	27.4
1922	26.09	2.80	.84	3.64	.22		.11	.52	30.5
1923	27.51	2.74	.98	3.72	.29		.14	.54	32.2
1924	22.79	2.16	.80	2.96	.36		.07	.52	26.7
1925	26.17	2.14	.84	2.98	.50		.11	.65	30.4
1926	27.00	2.14	.74	2.88	.51		.14	.65	31.1
1927	29.74	2.14	.79	2.93	.83		.09	.70	34.2
1928	26.08	1.90	.82	2.72	.82		.11	.71	30.4
1929	27.74	2.05	.93	2.98	1.08		.11	.78	32.6
1930	20.97	1.61	.50	2.11	.95		.13	.65	24.8
1931	21.10	1.89	.58	2.47	1.26		.06	.70	25.5
1932	19.46	1.49	.33	1.82	1.23		.06	.59	23.1
1933	23.96	1.93	.56	2.49	1.71		.08	.55	28.7
1934	20.76	1.31	.48	1.79	1.54		.09	.47	24.6
1935	21.36	2.47	.76	3.23	2.01		.10	.56	27.2
1936	26.74	2.31	.82	3.13	2.48		.10	.52	32.9
1937	27.92	2.10	.82	2.92	2.33		.11	.49	33.7
1938	22.18	1.67	.49	2.16	2.50		.03	.43	27.3
1939	27.34	2.21	.78	2.99	3.46		.11	.42	34.3
1940	29.55	2.31	.73	3.04	3.60	0.04	.09	.36	36.6
1941	38.37	3.80	.99	4.79	4.37	.09	.07	.19	47.8
1942	41.21	4.10	.32	4.42	4.54	.18	.17	7/	50.5
1943	38.03	4.35	.24	4.59	4.73	.27	.10	7/	47.7
1944	34.14	4.11	.33	4.44	5.02	.34	.07	7/	44.0
1945	31.85	4.16	.39	4.55	5.43	.36	.05	.01	42.2
1946	33.54	4.25	.89	5.14	6.11	.39	.09	.09	45.3
1947	31.93	3.60	1.18	4.78	6.76	.34	.06	.02	43.8
1948	30.02	3.26	1.40	4.66	7.73	.48	.04	.05	42.9
1949	25.37	2.24	1.07	3.31	6.57	.61	.04	.03	35.9
1950	30.45	2.84	1.29	4.13	8.79	.92	.07	.07	44.4
1951	30.99	2.44	.65	3.09	8.15	1.31	.07	.05	43.6
1952 6/	28.16	2.18	.75	2.93	7.63	1.62	.04	.08	40.4

1/ Mill consumption as reported by the Bureau of the Census. For American cotton, tare of 22 pounds was deducted from gross weight of bale produced through 1923; for 1924 and thereafter tare as reported by the Crop Reporting Board has been deducted. For foreign cotton, 3 percent (15 pounds) was deducted. 2/ Mill consumption, scoured basis, as reported by the Bureau of the Census. 3/ Domestic shipments plus imports for consumption as published in Textile Organon. 4/ Imports and estimated production as reported by the Bureau of the Census, Bureau of Plant Industry, and Portland, Oregon, office of Bureau of Agricultural Economics. 5/ Net imports through 1933; imports for consumption as reported by the Bureau of the Census for 1934 and thereafter. 6/ Preliminary. 7/ Less than 0.005 pounds.

Table 2.- Percentage distribution of mill consumption of cotton, wool, rayon and acetate, other man-made fiber, flax, and silk, United States, 1921-52

Year	Cotton 1/	Wool 2/			Rayon and acetate 3/	Other man-made 3/	Flax 4/	Silk 5/	Total
		Apparel	Carpet	Total					
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
1921	86.0	10.0	1.4	11.4	0.6		0.3	1.7	100.0
1922	85.3	9.2	2.7	11.9	.7		.4	1.7	100.0
1923	85.4	8.6	3.0	11.6	.9		.4	1.7	100.0
1924	85.4	8.1	3.0	11.1	1.3		.3	1.9	100.0
1925	86.1	7.1	2.7	9.8	1.6		.4	2.1	100.0
1926	86.6	6.8	2.4	9.2	1.6		.5	2.1	100.0
1927	86.7	6.3	2.3	8.6	2.4		.3	2.0	100.0
1928	85.7	6.2	2.7	8.9	2.7		.4	2.3	100.0
1929	84.9	6.3	2.8	9.1	3.3		.3	2.4	100.0
1930	84.5	6.5	2.0	8.5	3.9		.5	2.6	100.0
1931	82.5	7.4	2.3	9.7	4.9		.2	2.7	100.0
1932	84.0	6.5	1.4	7.9	5.3		.3	2.5	100.0
1933	83.2	6.7	2.0	8.7	5.9		.3	1.9	100.0
1934	84.2	5.3	2.0	7.3	6.2		.4	1.9	100.0
1935	78.4	9.0	2.8	11.8	7.4		.4	2.0	100.0
1936	81.1	7.0	2.5	9.5	7.5		.3	1.6	100.0
1937	82.7	6.3	2.4	8.7	6.9		.3	1.4	100.0
1938	81.2	6.1	1.8	7.9	9.2		.1	1.6	100.0
1939	79.7	6.4	2.3	8.7	10.1		.3	1.2	100.0
1940	80.6	6.3	2.0	8.3	9.8	0.1	.2	1.0	100.0
1941	80.1	7.9	2.1	10.0	9.1	.2	.2	.4	100.0
1942	81.6	8.1	0.6	8.7	9.0	.4	.3	7/	100.0
1943	79.7	9.1	.5	9.6	9.9	.6	.2	7/	100.0
1944	77.5	9.4	.7	10.1	11.4	.8	.2	7/	100.0
1945	75.4	9.9	.9	10.8	12.8	.9	.1	7/	100.0
1946	73.9	9.3	2.0	11.3	13.5	.9	.2	.2	100.0
1947	72.8	8.2	2.7	10.9	15.4	.8	.1	7/	100.0
1948	69.8	7.5	3.3	10.8	18.0	1.2	.1	.1	100.0
1949	70.6	6.2	3.0	9.2	18.3	1.7	.1	.1	100.0
1950	68.5	6.4	2.9	9.3	19.7	2.1	.2	.2	100.0
1951	70.9	5.6	1.5	7.1	18.6	3.1	.2	.1	100.0
1952 6/	69.6	5.3	1.9	7.2	18.9	4.0	.1	.2	100.0

1/ Mill consumption as reported by the Bureau of the Census. For American cotton, tare of 22 pounds was deducted from gross weight of bale produced through 1923; for 1924 and thereafter tare as reported by the Crop Reporting Board has been deducted. For foreign cotton, 3 percent (15 pounds) was deducted. 2/ Mill consumption, scoured basis, as reported by the Bureau of the Census. 3/ Domestic shipments plus imports for consumption as published in Textile Organon. 4/ Imports and estimated production as reported by the Bureau of the Census, Bureau of Plant Industry, and Portland, Oregon, office of Bureau of Agricultural Economics. 5/ Net imports through 1933; imports for consumption as reported by the Bureau of the Census for 1934 and thereafter.
6/ Preliminary. 7/ Less than 0.05 percent.

WOOL RESEARCH (UTILIZATION) AT THE WESTERN REGIONAL RESEARCH LABORATORY

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The broad objective of this bureau's investigation on wool and mohair at the Western Regional Research Laboratory in Albany, California, consists of (1) fundamental investigation on composition, quality evaluation and preservation, comprising physical, chemical, and biochemical studies aimed to provide the necessary background of basic data for development of improved fibers and improved processing techniques and (2) applied investigations aimed to adapt the basic information to improved treatments and processing of wool and mohair covering all phases of processing from scouring of grease wool to laundering of the finished cloth.

A new principle for scouring wool has been discovered in which butyl alcohol is added to water in low concentration to enchance the removal of the grease by the suint salts. The suint salts are perspiration residues present in all greasy wool. The new method has been proved in a laboratory scale continuous scouring apparatus which simultaneously recovers the grease and suint as byproducts and recycles the butyl alcohol.

Basic studies of the mechanism of cleaning action in laundering have demonstrated that the presence of certain proteins and certain synthetic high polymers in low concentration in synthetic detergent cleaning solutions are highly effective in preventing the redeposition of soil on fabrics during the laundering. These studies on the mechanism of soil redeposition in cleaning have demonstrated that certain molecular properties of the whiteness retention agent are required for this activity.

Comparative studies of several important mechanical properties of wool from five breeds of sheep representing wide range of fineness have been made. The mechanical properties tested include the stiffness, ease of stretching and ability to recover from stretching. The results of these tests, analyzed statistically, indicate that even when sheep of different breeds are raised under the same environmental and dietary conditions the techanical properties still differ significantly, and that although the fineness (diameter) of the wool fibers strongly influences the mechanical properties, the property of crimp (waves or kinks per inch) influences the fiber mechanical behavior independently. The wool from the Suffolk breed was found to behave more like the wool from the fine and highly crimped Rambouillet sheep than it does like the wools of similar coarseness having low crimp. This further knowledge of wool as a raw material is a significant advance towards standardization of its processing and modification.

In a contract investigation supported at the Textile Research Institute, Princeton, New Jersey, by the Deparment and administered by the Bureau, the resting of wool in the top form or in the roving has been studied in relation to the return of crimp pulled out in carding and combing and in relation to

spinning efficiency. Aging or resting of wool improves the spinning efficiency when yarns are spun close to the limit for the quality of the yarn involved. The steaming of yarns or roving hastens the aging process. The work on aging of wools has suggested a useful field for further investigation to determine more precisely the effects on fiber processing. Eventually this knowledge may be put to work to accomplish savings in processing by cutting valuable time lost in yarn breaks.

Detailed study of the chemical building blocks of wools and mohair have been made including comparison of molecular size of proteins isolated from wools and mohair of widely different breeds of sheep and goats. A comparison has also been made of the amino acids of various wools. Despite the similar molecular properties of the proteins of wools and mohair the amino acid compositions of wools different in fineness differ significantly.

Fundamental studies of the chemical modification of wool structure have demonstrated that the chemic l agent propiolactone will penetrate the wool fiber and interact with the wool building blocks and with itself to form a resin. These reactions lead to altered properties of the fiber. Significant among the changes noted are improved dyeing and felting properties. Other chemical agents which modify wool and mohair are being similarly studied. Among the useful modifications of wool sought are stabilization of the fiber toward damage by alkali, acids, light, abrasion, and degradation by moths and other biological agents. The Bureau of Entomology and Plant Quarantine is assisting in the biological tests.

A new technique for investigation of wool structure and its modification has been discovered which involves the use of the rhodamine-b. This red dye penetrates the fiber and serves as a molecular probe to reveal available chemical reactive sites within the fiber. Such tests are of significance for comparison of wools, natural and modified, and assist in development of improved modification treatments.

In addition, an investigation of the molecular interaction of water and wool using specialized electrical methods has shown that when water penetrates the fiber portions of the wool molecules gain increased freedom to rotate in the electrical field. The water acts as a lubricant. This new tool will also assist in the systematic modification of wool towards new and improved characteristics.

WOOL AND MOHAIR RESEARCH WORK OF THE WOOL DIVISION, LIVESTOCK BRANCH, PRODUCTION AND MARKETING ADMINISTRATION

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The facilities at the Denver Wool Laboratory consist of reasonably well equipped testing laboratories for carrying on shrinkage or clean yield research, and also for testing wool and mohair for fineness or diameter denoting grade, variation within and between lots, length of grease wool staples, and fiber length of top and its variation. Testing can be done under constant temperature and humidity conditions. Most of the equipment is more or less or a standardized nature, and there are shop facilities available for developmental work of tools and equipment.

The work may be classed into the following three broad categories:

1. Development of standards for the measurable physical characteristics of wool, wool top, mohair, and mohair top.

2. Improvement of tools, techniques, and methods of sampling and testing wool and mohair for their practical application of the commodity.

3. Improvement in marketing practices of wool to enhance their acceptability to the mills.

1. In 1939 the Department officially promulgated wool top standards for fineness and variation for grades 80s to 50s with measurement specifications and visual practical forms for grades 48s to 36s. More recent research through assistance of industry pointed to improvement of top specifications by way of slight revision and simplification in the requirements. A new grade, 54s, is recommended and also official fineness requirements in microns is recommended for the lower grades of top 48s to 36s. (Federal Register, July 23, 1953). These revisions are awaiting suggestions before official promulgation.

Grease Wool Specifications for Fineness and Length - A considerable amount of data has been developed as a basis for establishing fineness and length specifications for grades of grease wool, referred to as a "grease wool to top study." With the cooperation of industry, we have been able to test more than 100 lots of wool for fineness, variation, and length from samples of card sliver, top, and noil. The measurable dimensional changes which take place in converting grease wool to top are being determined for each grade by measuring samples of the wool at the various stages of processing. With known measurement requirements for fineness and variation for all grades of wool top, and with knowledge of dimensional changes which normally occur in converting grease wool to top, it is planned to develop micron measurements for grades of grease wool which will be correlative with corresponding grades of top. With the normal relationship of grease wool to top established, it should be possible to determine within a reasonable degree of accuracy, the kind of top that can be produced from a lot of grease wool of known quality and, conversely, the kind of grease wool required to produce top of certain requirements.

A report currently is being released which suggests grease wool staple length requirements for the various grades of wool. The suggested length ranges for the various grades are based on length studies of numerous lots of wool commercially graded, together with information obtained in the grease wool to top study and from direct suggestions of the trade. The length measurements suggested are based on the unstretched staple length. The unstretched staple length was established as a basis for length determination of grease wool from studies previously made which show the length of the unstretched staple to compare much more favorably to the top length than did the length of the stretched staple.

Visual Samples for Market Grades of Grease Wool - Sets of wool samples illustrating for fineness, feel, and general appearance of the wool for each of six market grades; fine, 1/2 blood, 3/8 blood, 1/4 blood, low 1/4 blood, and braid, have been prepared for use as an aid in grading fleeces. These sets have been distributed to wool handlers, manufacturers, wool departments of colleges, and others for comment regarding their adequacy for fleece grading purposes. When these sets have been accepted by the trade or modified to meet agreed upon changes, it is planned to make such sets available for distribution as a regular marketing service in the hope that they will aid in improving and obtaining greater uniformity in the grading of fleeces according to fineness wherever the grading is done.

Standards for Grades of Mohair - Proposed mohair grades were developed in 1950. Sets of physical samples representing seven grades for spring and seven grades for fall shorn hair were distributed to dealers, manufacturers, colleges, and growers for their information and comment. The mohair was measured for fineness and these findings were circulated and discussed with members of the trade and the A.S.T.M. These measurements formed the basis for change of mohair specifications in the A.S.T.M. manual. Following completion of current research projects involving wool standards, it is proposed to undertake the same type of investigation and study for both mohair and mohair top as is now being carried on for the grease wool standards. The continued assistance and cooperation of the industry on these problems will be needed.

Determination of Shrinkage - Several years ago the Department of Agriculture adopted an objective method of determining shrinkage in grease wool. The method being used is to draw core samples by mechanical means. Work toward simpligying and improving the accuracy of this method continues. It involves primarily:

a. The method of taking the sample of grease wool.
b. Adequacy of coring patterns.
c. Procedures or techniques for testing the sample in the laboratory.
d. Relationships of core yields to mill scoured yield and to top, noil, and waste yield.

Scourable Branding Paint - In connection with wool shrinkage and scouring research, the Wool Division Laboratory, some years ago, developed a scourable branding paint for use in marking sheep. This paint has been tested for its practical application regarding weathering and scouring properties on the flocks of sheep at the Western Sheep Breeding Laboratory and U. S. Sheep

Experiment Station at Dubois, Idaho. Results on some of this work were published in June and July 1950. Several commercial companies are manufacturing the paint for distribution. The Wool Laboratory has also developed a method of test for scourability which should be helpful to anyone interested in determining the scourabilityof paint brands.

Other qualities which serve as a basis for evaluating wool and mohair such as soundness or strength, crimp, color, handle, tippiness or wastiness, etc., will receive attention upon completion of work deemed more urgent.

2. Shrinkage Determination Purposes - Determination of shrinkage involves two processes, (1) the drawing of samples and (2) the laboratory testing of the samples. The present practice of coring bags or bales of grease wool has been developed upon research which tested various coring patterns for adequacy of sample and representativeness of the lot sampled. Possilbe improvements in sampling are being studied. The processing of the core sample is being further studied with a view toward simplifying the laboratory procedures, and for increasing the repeatability of tests. Research to date indicates the possibility of using a constant factor for determining residual ash and extractive content, thus simplifying and speeding up the laboratory processing of samples without sacrifice of accuracy. Improved procedures in scouring samples offer promise of greater consistency and repeatability in determining yield.

Preliminary investigations are being made to determine the feasibility of using a pressure coring tool to draw samples from bags or bales without the aid of an electrical power unit. This work has not been carried far enough to make positive conclusions, but the use of a small diameter pressure coring tool does appear to offer definite advantages.

Objectively Determining Fineness - The determination of fineness and fineness distribution of grease wool has been proved practicable by testing samples drawn with a small diameter coring tool. The check testing of wools for fineness in connection with the CCC price support program is being carried out by measuring a portion of the core sample drawn for shrinkage determination purposes.

Objective Sampling for Length and Variation - A tool for drawing of staples from bags or bales of grease wool has been developed as a means of objectively sampling lots of grease wool for staple length. This tool and its use is being perfected in connection with other research work.

3. Improvement in Marketing Practices - Other research work involves a study of ways and means of improving the preparation of wool clips to enhance their acceptability by the wool trade. Whereas, the original work involved the study of the practicability and economic feasibility of grading, sorting, or skirting wools at ranches or at interior warehouses, the major contribution of the research work resulted from information developed through the processing of representative portions of the grease wool lots so graded or sorted. Work in connection with this project has indicated the need for first establishing standards for various measurable qualities of grease wool with the ultimate objective of making possible the sale of wool on the basis of description.

By developing satisfactory measures for the principal characteristics, it is believed that a more sound and understandable basis of trading will result. If a lot of wool were prepared in accordance with fineness and length guides (standards or requirements) and if test results were made available to show (1) average diameter and uniformity in microns, (2) average staple length in inches and its uniformity, (3) clean yield and perhaps additional information about handle, soundness, color, etc., the growers or dealers could submit such information to the manufacturer or buyer. The buyer consequently would know more precisely what he was purchasing and hence be able to meet his raw commodity demands with greater certainty.

Miscellaneous (Service Work) - In addition to work of strictly research nature, the Wool Division Laboratory at Denver performs other functions such as:

1. Preparation and distribution of practical forms of the official standards for wool top, grease wool matchings, and grease mohair grades.

2. Check testing wools in Price Support Program for fineness in the micronaire instrument as a check on the grade placement assigned by appraisers.

3. Testing every twentieth core sample of grease wool for accuracy of commercial laboratories in reporting shrinkage.

WOOL RESEARCH IN THE BUREAU OF ANIMAL INDUSTRY

ANIMAL HUSBANDRY DIVISION
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Wool research of the Bureau of Animal Industry is largely conducted on wool grown on individual sheep or groups of sheep. These sheep are maintained in three localities, each environmentally different. Dubois, Idaho, is typical of the mountainous Western States. Fort Wingate, New Mexico, represents the rougher, tougher Southwest, and Beltsville, Maryland, is fairly similar to the Eastern half of the United States.

The objective of the Station at Dubois, Idaho, is "to improve sheep for lamb and wool production under range conditions. In the pursuit of this objective, basic breeding methods are employed; heritability analyses are made of the various utility factors, and the selection of breeding animals is based upon production as that is measured under range environment. Emphasis is placed primarily on the quantity and quality of lambs produced; the staple length, quality and quantity of clean scoured wool, and upon the adaptability and longevity of the sheep. To accomplish this, studies of a fundamental nature are underway employing line breeding and testing lines for their combining ability. Studies are also underway to improve selection practices for the utility factors mentioned above."

In addition to improving the well known Rambouillet breed, two new breeds have been established at Dubois, the Columbia and the Targhee. The Columbia produces predominately 56/58s wool, and the Targhee approximately 96 percent

60/62s and finer. These new breeds have been evolved through crossing Lincoln, a coarse wooled sheep, with the Rambouillet, a fine wooled sheep. From the standpoint of wool improvement, these crossbred sheep had to be selected for uniformity of fiber diameter, long staple length, heavy clean yield of fleece. Likewise, these sheep were culled for excessive medullation, excessive hairiness, kempiness, and lack of productivity. The above fleece characteristics are determined by sampling and measuring wool samples taken from individual sheep for determination of mean fiber diameter, its variability, percent of medullation, and its staple length. The present yield of clean wool is determined by laboratory scouring and computing individual clean fleece yields on a bone dry basis. A high correlation between the yield of small side samples of wool and the entire fleece itself has been established. We have been able to increase the proportion of Rambouillet rams producing strictly fine staple fleeces from 92 percent in the period 1942-1945 to 98 percent in 1953.

The entire clip at Dubois, Idaho, from 1949 to the present date, was sorted at the Station. Each sort from each sheep was recorded as to its identity, type, grade and weight. These matchings, except for those from the yearling Targhee rams and ewes, representing over 30,000 pounds annually, were baled and used in cooperation with the Wool Division, Livestock Branch, Production and Marketing Administration for studies of the commercial values of sorted wools. In 1950, the main sorts of Targhee yearling ram and ewe fleeces were individually sacked and identified and shipped to Beltsville, Maryland. At this location, these matchings were subsequently scoured, carded, and combed. From the carding and combing data produced further analysis of data will be made to determine relationship to other traits and to obtain estimates of heritability.

Cooperative research has been developed in the following fields: (1) with the Textile Research Institute and the Forstmann Woolen Company in a comparison of Australasian and domestic wool; (2) with the Wool Division of the Production and Marketing Administration in standardization and processing; and (3) with the Bureau of Human Nutrition and Home Economics on the properties and usefulness of Columbia sheep wool in fabrics.

In cooperation with the New Mexico State Agricultural Experiment Station, the Southwestern Range and Sheep Breeding Laboratory located at Fort Wingate, New Mexico, is developing types of sheep which are adapted to the semi-arid range conditions of the Southwest, and to the economic requirements of Navajo Indians. Emphasis has been placed on high yield of wool and its suitability with respect to hand weaving and for commercial manufacture. Another important objective aims at improvement of fine wool sheep which are adapted to this semi-arid area.

The Agricultural Research Center at Beltsville, Maryland, has as one of its wool research objectives a project involving the fabrication properties of wool from sheep of known genetic history. For the years 1950, 1951 and 1952, the matchings from yearling Targhee ewe and ram fleeces were individually sacked and sent to Beltsville for scouring, carding, and combing. We are able to card and comb each matching as an individual and to obtain yields from card sliver, card wastes, burry wastes, tops, noils and slubbing, and to use this processing data in our search for individual sheep producing wool of superior fabrication characteristics. From these data our geneticists at

Dubois, Idaho, will determine the heritability and practicability of selection for those sheep producing the widest tops to noil ratio. As a result of this work to date, we have found a range in percent of card yield on a clean scoured basis of 80.5 to 90.3 percent for fine wool, of 82.1 to 91.4 percent for 60/62s and of 81.7 to 94.0 percent for 56/58s. The tops to noils ratio on the basis of clean scoured wool has been found to be 5:1 to 11:1 for 64s and finer; 5:1 to 15:1 for 60s wool, and 6:1 to 15:1 for 58s. We have under contract with the Lowell Technological Institute Research Foundation an agreement which provides for processing a limited number of these individual tops into yarn. Although the individual lots will be few in number, from the data derived in processing and evaluating these, we will be able to draw conclusions upon the feasibility of carrying our operations to this stage.

The Animal Fiber Laboratory at Beltsville is responsible for deriving clean fleece yields and mean fiber diameter of the wool produced by the flock of experimental sheep at Beltsville. We also have a histological section investigating the critical stages in the growth development of fibers on unborn or suckling animals.

In conclusion, the wool research program of the Bureau of Animal Industry is one which is geared for long range improvement of fleeces by selecting those sheep which produce the best wool. We are seeking those characteristics of greatest importance to the sheep producer and to the wool manufacturers.

INSECTS ATTACKING WOOL AND WOOL PRODUCTS, BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Randall Latta
Washington, D. C.

The Bureau of Entomology and Plant Quarantine has very good facilities for studying this problem due to extensive participation in a research program for the office of the Quartermaster General for the past five or six years. In this program techniques have been developed, large stocks of fabric pests established, test storage rooms prepared, and contacts with industry established. Cooperation is carried on with the Quartermaster laboratory at Philadelphia, with the Bureau of Animal Industry, the Western Regional Research Laboratory, and the Wool Division, Production and Marketing Administration.

Considerable research has established that treatment with DDT provides excellent protection to wool against insect damage for several years. Several ways of treating wool or wool products have been developed. Raw wool can be protected by spraying the bags with DDT. Woolen cloth can also be protected. Rolls of Army uniform cloth treated with DDT were protected for more than five years in the presence of a vigorous infestation; uniforms made from cloth treated two years prior to tailoring were still undamaged after four additional years' storage in the presence of the same vigorous infestation. Boxed uniforms were protected by spraying the outer and inner surfaces of the boxes and the exterior of the bundles of clothing with a DDT-chlordane solution. The Quartermaster Depot at Philadelphia, which stores all the uniform cloth for the Army and Air Force, now impregnates all the wool cloth with DDT during the padding process.

EQ-53, a nonionic emulsifiable concentrate of DDT, was developed and the formula made available to industry. Over 80 brands are now on the market for purchase by the housewife to treat her washable woolens. It was discovered that washable woolens picked up DDT selectively from a dilute emulsion, so it is necessary to add only one tablespoonful of the concentrate to the wash or rinse water for each pound of dry wool. This will protect woolens in storage for a year or more. Dry-cleaning will remove the DDT.

Many inquiries have been received from industry exploring the possibilities of using EQ-53 on woolens during the manufacturing or processing of woolen products.

Tests are underway at Beltsville in cooperation with the Bureau of Animal Industry to treat wool with EQ-53 during the scouring process to determine the levels of DDT remaining after carding and combing. These results will be released to industry as soon as the tests are completed.

Rugs can be protected by DDT even under heavy use conditions. The best method of application for the housewife is to spray a 5-percent DDT oil solution on the rug.

Tests are underway to evaluate the protection given by various materials added in the dye bath.

Much research is being done on residual insecticidal treatments to be applied in homes, warehouses, mills, etc., as part of an insect prevention program. The periodical use of aerosols looks promising since this method requires a minimum amount of labor and is relatively inexpensive.

Cooperation is given to the Western Regional Research Laboratory by evaluating the resistance to insect attack of the modified wool samples prepared at that Laboratory.

WOOL RESEARCH OF THE FARM CREDIT ADMINISTRATION

Walter L. Hodde
Washington, D. C.

The cooperative Research and Service Division was created in 1926 to conduct research, service and education work for farmers and ranchers cooperatives. There are 125-150 wool pools in this country that are relatively simple in organization and operation. These pools plus 24 state and regional wool pools have handled from 19 percent to over 30 percent of the shorn wool crop during 1946-52. Ohio Wool Growers and Pacific Wool Growers are independent. Twenty-two large scale co-ops receive financial and sales service from National Wool Marketing Corporation in Boston. Most of our work is with large scale wool co-ops that have complicated problems in broad fields -- what, where, when, how, who and where. Examples of recent work are (1) educational bulletin on wool and cooperative marketing; (2) study of use of futures trading by cooperatives; (3) study of selling methods eg private treaty vs auctions vs sealed bids. Hope to publish these within next year or two. Among many problems are (1) selling on description, and (2) preparation for sale that we want industry opinions on.

As of September 1, we find Australian Type 77 costing manufacturers something like 20 cents per clean pound more than comparable domestic wool after allowing for difference in conversion costs. Should we sort our wool to make it as attractive as foreign? Commodity Credit Corporation wools might be used for experiments during the next few years.

This business of selling on description or description and small representative samples should be very helpful if we can develop practical procedures. Cotton and wheat are sold by description in accordance with standards. The work of the Wool Division, Production and Marketing Administration, on standards and sampling and testing, is fundamental and basic to progress in marketing. There is much expense and inefficiency in present wool inspection and marketing in general. A system like the following (blackboard example) might be worth trying out.

RESEARCH ON WOOL PRODUCTS FOR CLOTHING AND FOR THE HOME

BUREAU OF HUMAN NUTRITION AND HOME ECONOMICS
DIVISION OF TEXTILES AND CLOTHING
Suzanne Davison
Beltsville, Maryland

The Bureau of Human Nutrition and Home Economics is one of the six bureaus comprising the Agricultural Research Administration. It is authorized by the Congress to "conduct investigations on the relative utility and economy of agricultural commodities for food, clothing, and other home uses." Cotton and wool are, therefore, of direct interest.

The four research Divisions in the Bureau are Family Economics, Textiles and Clothing, Food and Nutrition, and Housing and Household Equipment. The first two are concerned with clothing and household textiles.

The Family Economics Division collects and analyzes facts on what the homemaker buys, what she has on hand, and the use made of different commodities. For example, a recent study in which families in two cities and a rural area were interviewed shows the differences in wardrobes and purchases among families of various incomes, occupational needs, and compositions.

More detailed information on family practices in the purchase, use and care of selected articles is needed as a basis for determining the characteristics in fabrics which best meet present requirements of consumers. Such facts would make for more effective utilization of wool, and help in the formulation of educational programs for homemakers.

The Textiles and Clothing Division conducts studies to assist homemakers in the selection, care, and use of the family's clothing and household textiles. Some of its research involving wool fabrics has dealt with the serviceability of trousers made from wool serge; the use of household detergents in the laundering of wools; and the techniques in the home construction of wool clothing.

The Bureau's Textiles and Clothing Division is interested in additional research along the following lines:

1. The basic relationship between wool fabric structure and properties.

   The Bureau now has under way studies of the effect of yarn and fabric structure on the dimensional stability of cotton knit goods. Similar work is needed on both knit and woven wool materials.

2. Amount and type of impairment in wool fabric quality produced by fiber blends.

   Research-based facts are needed to help consumers differentiate between values when selecting fabrics for specific clothing and household uses.

3. Improved ways of caring for wool textiles in the home.

   Current development of washable wools and new types of household laundering aids are increasing the feasibility of washing wool garments at home. Methods of washing and pressing should be devised which will preserve the original appearance and characteristics of the articles. The possibility of developing safe, inexpensive methods of home dry-cleaning should also be investigated.

4. Construction techniques for making washable wool garments.

   The development of types of construction which would make possible the washing as well as dry cleaning of wool garments would contribute to the effective utilization of wool.

The results of the Bureau's research are published in technical and popular articles, in Department bulletins and circulars, and in visual aids, such as films and loan exhibits. These publications and exhibit materials are widely used by the Extension Service and by teachers and other educators working with families. An example of the loan exhibits are those now in circulation entitled "Buying Men's Suits" and "Tailoring." A film on men's suits is now being prepared in cooperation with the Extension Service and the National Association of Retail Clothiers and Furnishers. This will be used by retailers in educational programs for salesmen and by Extension specialists in their work with groups of rural women.

WOOL RESEARCH AT THE EASTERN REGIONAL RESEARCH LABORATORY, BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY

Abner Eisner
Wyndmoor, Pennsylvania

Previous efforts toward an increase in wool grease utilization have been concentrated on applications research on both crude and refined grease. It is felt that an increase in utilization might result if more were known about the chemical composition and nature of its constituents. Our researches have been directed toward supplying this much needed information and concerns itself with improvements in methods of separation, fractionation, and characterization of the components of the fractions. These investigations lie in three categories: (1) saponification, (2) alcohol fraction, and (3) acid fraction.

Since the recovery of the acid fraction after breakdown of wool grease by a method developed previously was unsatisfactory, a re-examination of the sodium-hydroxide grease splitting method was made. One of the chief obstacles in the former use of this procedure was the difficulty of separating the alcohol portion from the sodium soap emulsions. Hydrocarbon extraction at elevated temperatures (70-80° C.) obviates this trouble. As another approach to the cleavage problem a study of the transesterification of wool wax by methyl acetate was made. The results of this study show that this reaction proceeds only to the extent of about 40% of theory and hence is of small value.

Most of the work on the alcohol portion was pointed toward fractionation. Reproducible results have been obtained using urea adduct formation as a means of preliminary fractionation. Using this method, a fraction comprising 20% of the unsaponifiables and composed of long chain alcohols, was separated from the mixture. Molecular distillation and chromatography have also been tried as separation techniques. A method for the quantitative estimation of the steroids present has been developed and is to appear in the October issue of Analytical Chemistry.

Chromatography has also been applied to the wool wax acid mixture. Some encouraging results have been obtained in the preliminary separation of hydroxy acids from non-hydroxy acids. A method has been developed, using non-aquous titration techniques, for determining the acid number of wool wax acids. A publication describing this method is being prepared.

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